

THE STAR INSIDE THE APPLE:
ON THE DESIGN OF A WONDER-FULL EDUCATION

by
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Preamble: What Is Wanted

The title of this essay -- “The Star Inside the Apple” -- has everything to do with my purpose, as is proper and expected. It comes from a story recounted by David Perkins in The Mind’s Best Work (1981). His son comes home and shows him something learned that day in kindergarten. Follow along at home, it goes like this: slice an apple perpendicular to the stem and look inside. There it is, perfect and beautiful, a star.

In cross-section, the core of the apple made a distinct five-pointed star. How many apples had I eaten in my life, cutting them in half the right way and never suspecting the hidden pattern waiting for me until one day my child brought news of it home, out to convert the infidel -- and he did. (p. 288)

The primary goal of education should be wonder. How many hidden patterns remain obscure because our schooling teaches us to be jaded? Do you respond to the apple-star with a shrug and a yawn? Or with delight? For reasons that will grow ever more obvious, I now consider the apple an educational tool more compelling than any textbook or CD-ROM. As I feel my way toward the structure of a new curriculum, this humble fruit would see heavy action. In art class, as a lesson on how to look for and see patterns everywhere; in literature, how to generate vigorous metaphors. In geometry, the apple as lesson number one, so that no child will ever ask, “What use is this?”, not when she sees the principle of five-ness manifest as a luscious snack and a mystery all at once. Each student munches on her lesson as the class reflects on and discusses poetic Kepler (as cited in Schneider, 1994): “Where plants have five-fold patterns, a consideration of their souls is in place” (p. 96). Quite the tasty introduction to customarily dry geometry.

By no means do I intend this paper as a final word on any educational matter; on the contrary, this represents my first formal exploration of the subject. As such, what follows is speculative, a mix of introspection and advocacy, and in fact constitutes a

curriculum rationale, a search for the germ of a design. Toward this end, several sources are identified -- philosophers of education -- who may be useful and, within those sources, the principles that lend themselves to such a design. How might these principles be implemented in a classroom? In what developmental state do children arrive at school? Many questions, each deserving of its own essay.

The Problem of Education

The problem of education has been on my mind for years. What is it about this issue that fascinates me? Why is it important? Why does the problem of education resist every attempt at resolution? Though I prefer to avoid blanket condemnation, any pretense of complete objectivity would be improper: if my aim is to design a new curriculum, then obviously I am unimpressed with at least some present-day education trends. Both my critique and suggestions involve teleology, that is, the use of ultimate purpose to explain some phenomenon -- school, in this case.

The matter of education is important. Everyone says so. What politician would commit career suicide by stumping against education? What parent does not want the best schools for her child? School quality alone can raise by thousands of dollars the value of otherwise similar houses in contiguous counties. And yet when federal and state budgets are examined, an apparent disconnect between rhetoric and reality is discovered. The difficult business of educating children, as challenging as surgery or atom-splitting, trails by millions such endeavors as bomb-building and road-paving in the quest for funds. The same disconnect appears when comparing research on how humans learn

with how children are taught, as if the loop between research and practice were ruptured. This is one of many puzzles to be solved before anything like progress is feasible.

Once upon a time I believed this problem of creating lifelong learners might be amenable to solution at the undergraduate level. Maybe there needed to be more incentive to hazard a general education in specialized times. Perhaps if the reward structure for faculty were altered so that communication between faculty of different disciplines -- and not only the familiar pairings of, say, sociology and psychology, but also the radical boundary-spanning of a physics-poetry exchange -- if this communication received the same respect as research, then faculty could model a constant cross-disciplinary involvement with knowledge for students to follow.

Indeed, steps have been taken at UNC-Chapel Hill to improve the intellectual climate, and the Report of the Chancellor's Task Force on Intellectual Climate (1997) contains a host of admirable proposals. After a close reading of the document, however, it is clear that this is an uphill battle, and a pessimist would label it doomed. The document mentions the need to "engage students in an intellectual life when they first step on campus" (p. iii) and admits that "too many students are heavily influenced by a popular culture that devalues intellectual life" (p. 1). Taking this admission as a given -- in fact it is the sort of condemnation I strive to avoid as counter-productive -- the statement that follows strikes me as excessively optimistic: "Students may not embrace a more encompassing intellectual life because they lack adequate socialization. A rigorous first year experience can reshape students' norms and alter their expectations" (p. 3). This requires an enormous leap of faith. Undo more than a decade of socialization in a year? Can this even be done at all? Perhaps so, but with what success rate? Five percent

of first year students converted to insatiable learners? Ten? This seems to be an attempt to rekindle a long-dormant curiosity about the world, a curiosity that burned in childhood but that was anaesthetized -- for many, euthanized -- in adolescence. I wish the school luck.

I understand the inertia generated by this kind of socialization. One of the great failures of my life consisted of not exploring an independent study option as an undergraduate. This program allowed the student to craft his own major field of study rather than pursuing the more familiar packages: American history, chemistry, political science, and so on. Instead, the student was credited with an ability to see affinities between disciplines, to link courses and knowledge into a coherent whole, and to investigate the structure of knowledge. All of this was beyond me. Nothing in my past, neither school nor personal initiative, prepared me for such an offer. I needed the familiar boundaries, the safe demarcations between disciplines, and therefore the illusion that knowledge kept meekly to its designated pens; long before I knew the meaning of the word "reified," it had happened to the structural function of disciplinarity. During a school day, students move through pockets of time, the edges of which are defined by bells and which bear labels such as music, history, and mathematics. The student can be forgiven if she forgets that mathematics has a history and that music is interpenetrated by mathematics. Only after years did I realize that the taxonomy of knowledge is an artifice of convenience, indispensable for an aerial view but never to be confused with a natural state: the danger is that from the air those boundaries begin to look concrete, even though the reality is that there is a constant flow of ideas across them. During the earliest stage of this paper, my advisor pointed out that I had been given no models for genuine inquiry.

True. The weight of evidence shifted my focus from the undergraduate level to some earlier time.

What about high school, then? My own experience leads me to believe that by high school a pattern of apathy is set, but perhaps high school has changed since that time. A watchful eye kept on newspapers for local stories on education, does not support such optimism. I read with pleasure, at first, but then exasperation, of a program that demonstrates how a good idea may be implemented to minimal effect. The International Baccalaureate is a program offered by 343 high schools in the United States. Hillside and Enloe are local schools that offer the IB degree, which features a research paper, community service, and that emphasizes connections between disciplines. This sounds like a model for curricular reform, yet rather than replacing the present moribund curriculum, the IB program is merely an addition to regular coursework. Educators must understand that school as it is now constituted does not engage students; the presence of the IB program serves as acknowledgement. Yet the measure is left unfinished -- an IB student is required to be incredibly dedicated, because she must complete a double course load. The IB student realizes that the regular curriculum has little to do with learning: "In history, we skimmed over everything. This year, we don't just learn names and dates. We learn the issues and the ideas" (Silberman, 1999). This from a junior at Hillside High School. Why, then, do educators stay with a model that is a proven failure? Certainly there is the issue of political will as well as political power, yet here is an alternative model in place: why no move to phase in the IB program and supplant the current system? Is there a feeling that only certain superior students can handle free inquiry?

Maybe the suspicion is that most students would no longer respond to education as an adventure, that something -- curiosity? -- has been extinguished.

This notion of extinguished curiosity gets at the heart of the problem. Its defining characteristic is a shrinking of the world. Here is irony: as we grow up into adulthood, our vision of the world and its possibilities becomes smaller. To be sure, we have greater access to the world as adults; certainly we have the tools necessary for a generous worldview. Yet, somehow, few of us preserve that sense of grandeur we had of the world as children, where the world functioned almost as a synonym for infinity. Curiosity shrivels to nothing after doses of age and schooling; we begin life amazed at everything but rapidly “progress” to a vision dominated by ATMs and the newest coffee bar to open in town. We are curious about our neighbor’s affairs but not about the spirals found in pine cone bracts, sea shells, and hurricanes. We could be curious about so much in the world. Extinguished curiosity is what is left us, little more than a fading echo or a ghost, a reminder at odd moments that once we regarded this planet as the most terrific puzzle ever made. My search is for a school environment that nurtures curiosity, and more – inflames it. I don’t know that any “standard” school accomplishes this aim.

Even in the Chapel Hill school system, one of those systems alluded to earlier that inflates housing prices by means of its excellence, the model is unchanged. Surely, though there might be grumbles, the sterling record of Chapel Hill High School helps make a case that the current model is viable. Yes, by all the usual measurements CHHS is a success. Shocking then, to find the extreme example of Manju Rajendran, a sixteen year old who, by conventional terms, dropped out -- she prefers the phrase “rising out” -- to launch a process called “unschooling.” Her eloquent valediction serves well as the

theme of this paper: “Learning cannot be forced. We can assimilate, memorize, quickly swallow information we are taught. However, we do not learn until we are curious about the information. Learning and freedom are inseparable” (Boyer, 1997, p. A1). What is going on when the showpiece of the state educational system is so utterly rejected by such a student? This is not a case of over-generalization or hasty conclusion; no claims are made on the basis of so few examples. The point is to provoke thought, and I find such a repudiation disturbing. How many other students think similar thoughts but do not have Ms. Rajendran’s mix of determination and gift for candid speech?

My attention is constantly turned to education because of its distressing reliance on, and faith in, testing as a valid measurement of learning. Governor Jim Hunt, in his 1999 State of the State address, relied solely on testing statistics and numbers to tout the state’s educational progress: a 34 point increase in Scholastic Achievement Test scores and competency test improvements by fourth- and eighth-graders (Wagner, 1999). The State Board of Education this year mandated that all high school seniors must pass an exit exam before graduation is permitted, a decision made over the protests of school superintendents and principals (Simmons, 1999). The most important question is the one not asked: what do these tests measure? Understanding? Rote memorization, a shallow grasp of soon-to-be-forgotten concepts? Gardner (1991) says that this question is not asked because it violates “an unwritten agreement: A certain kind of performance shall be accepted as adequate for this particular instructional context” (p. 6). Imagine a nation of students, including those at the schools considered top-notch, unwittingly participating in this sham. Imagine schools that let this continue, that release students into the world with a stamp of approval but nothing like real learning. Recall the earlier comment by that

Hillside High junior: “In history, we skimmed over everything.” One of the many reasons tests are ill-suited to measure understanding is that skimming, cramming, and a host of “strategies” are as effective as is genuine study; in fact, good students are often those who know how to be good students as defined by the current incarnation of schooling -- they understand the ways in which it is possible to shine without grasping the material. The very fact of cramming, which every student has done during his school career, is a symptom of dysfunction, for if students actually learned at school they would have no need to cram. Gardner (1991) strips the pretensions of efficacy from such instruments:

As disciplines proliferate and the burdens imposed upon the school increase, however, pressures mount to shift to more efficient forms of determining student progress. Enter the test. The test is the ultimate scholastic invention, a “decontextualized measure” to be employed in a setting that is itself decontextualized. Students learn about scientific principles or distant lands while sitting at their desks reading a book or listening to a lecture; then, at the end of the week, the month, the year, or their school careers, the same students enter a room and, without benefit of texts or notes, answer questions about the material that they are supposed to have mastered. (p. 132)

In the coming pages, I will pay more attention to context. For now, the very notion of a test sounds ridiculous as described by Gardner. Yet the test is ubiquitous, and to it is attributed -- by governors and boards of education -- great powers of measurement and prediction. There should be a discussion of what, exactly, is being measured. Is human achievement always reducible to test scores and letter grades? Is human potential? How about creativity and exploration? Does this testing ethos prevent the education system from nurturing such aspects simply because there is no measurement tool for them? That seems a poor excuse for tolerance of a system that offers little challenge and less excitement to children.

In this, educators have violated the most basic axiom of measurement, which is that people will strive hardest in those areas that are rewarded, or measured. In computer programming, early measurements of lines of code produced bloated, but not better, and often worse, programs. In education, students learn how to take tests but not the course content, and here I admit guilt. Having always been a terrific test-taker, I have nevertheless little to show for this talent. Information retained for the shortest possible term slipped away from me once its utility was finished. One of the questions a teacher can count on hearing several times during a semester and with greater frequency as a mid-term approaches, is “Will that be on the exam?” or “Will we be expected to know that on the test?” This should always be taken as indicating a failure of education. Both questions contain the seeds of the problem: the assumption implicit here is that the objective is to pass the test rather than understand the material. The idea that deep understanding might enable one to pass any test is not entertained. Another assumption is that whatever makes it onto the test is the truly important stuff, while the rest was simply a waste of time. This is not a healthy attitude toward knowledge and learning, but it is endemic to classrooms.

Walk the campus of any university and listen. This is a good way to take the pulse of undergraduates and their level of appreciation for learning. I hear, to the exclusion of all else -- at least with regard to educational matters -- much talk of grades and tests. Plans for cramming, jokes about the need to retain information long enough so it can be transcribed onto a multiple choice test, post-test scrambles to ask one another the answer to such-and-such a question -- to see if it was correctly answered, never because of curiosity about the subject -- and a depressingly cavalier attitude about essay

questions, which seem to exist only to provide an opportunity for clever students to scale heights of bushwah rather than to display thorough knowledge about some area. I take such talk as indicative of a problem with quantifiable measures as the sole means of evaluation. Students focus on the evaluative tools and neglect what those tools were designed to measure: learning. The only way the situation might be made worse would be for some high official of education to publicly declare the sham nature of tests while presenting them as salutary -- and elicit no shouts of outrage. Unfortunately, North Carolina school board Chairman Phil Kirk did exactly this.

Kirk's pronouncement that the state would go with exit exams included this illuminating sentence: "We need to let the public know the diploma means something and a single test that guarantees basic high school skills is the way to do that" (Timmons, 1999). The political nature of the exit exam, the fact that its true audience is not considered the students taking the test but is in fact the public, is here revealed. And that bit about guaranteeing basic skills, what of it? Why continue to aim so low after all these decades of education? Again, I agree with Gardner (1991) when he condemns the call for basic skills as hollow: students learn to read, yes, but only on a literal level, while missing both the ability to read for understanding as well as the desire to read at all. What a Pyrrhic victory that is for any literacy program.

Why This Matters

The preceding moves this essay to consideration of a new matter: Why is this important? Why shouldn't it be enough that students achieve basic literacy, do we need to care whether or not they continue to read and learn once they leave school? Isn't the

function of school to prepare students to find and hold a job -- this last according to Governor Hunt (Wagner, 1999) -- in a competitive market? These questions ask for some clarification of the purpose of school, and that is best done by first remembering that culture is socially constructed. Change is resisted because of the tendency to believe in the native reality of cultural constructions, e.g. tests have a bedrock validity that educators “discovered” rather than a situational validity that resulted from a specific theory of learning -- the transmission model, where teachers imparted objective facts to passive students. People know that change occurs, yet the unspoken belief is that it only occurs in other times and that the current era has arrived at a true state, a pinnacle of development in all aspects of life. We gape in wonder at the fifteenth century European ideal of female baldness, yet are unable to conceive that people of the twenty-fourth century will look in astonishment at the fashions considered de rigueur in the late twentieth. I find this a helpful check on the tendency to think of anything in education as a sacred cow, even the popular notion that students go to school to learn job-applicable skills.

Miller (1994, p. 24) lists several contemporary assumptions about education that restrict efforts to change, among them being the perception that education is naturally a political matter, that its primary concern is the economic growth of the nation, that teachers should control the learning process, and that only empirical knowledge is valid. Of the first, its baleful influence is accomplished by the inclination to turn matters specific to a profession -- educators in this instance -- over to those perhaps least qualified to make good decisions, politicians. As to the second, Miller (1994, p. 26) pens a short history of the public school system as first a handmaid to the need of industry for

employees in the 1830s, then as a laboratory for behaviorism in the service of efficiency, and now a training facility to keep America competitive. This is a history in which children have never been more than “economic units” and one that illustrates exactly how reality is socially constructed rather than some “thing” waiting only for our arc of development to carry us to where it dwells. The third holds to a model where the teacher is an unassailable fount of wisdom, and where “Like a corporate manager, the educator is concerned with the products of the educational process (test scores) and the products of the school-factory (young people)” (p. 27). The last is of course the keystone of the others, being the naive realist belief in complete objectivity even after Einstein and Heisenberg injected measures of uncertainty into physics, that most objective of sciences.

It is good to have these assumptions out in the open, it enlarges the problem space and allows more freedom of thought. To exercise this freedom, consider the matter in reverse by working from the end result -- the adult learner, or non-learner -- back through the school system that produced him: the promised teleological excavation. What manner of adults are produced by schools? Hard to generalize, difficult to say with any certainty, but many people agree that school should teach those skills necessary to survive in an Information Age, to find and hold a job. Basic skills. The imperatives of business and the economy are here paramount. Will this forever be the appropriate model, though? Will there ever be a time when the full developmental needs of children are given priority?

This essay is my small contribution to the exploration of a fresh approach, the new developmental theory called for by Bruner (1986):

Its central technical concern will be how to create in the young an appreciation of the fact that many worlds are possible, that meaning and reality are created and

not discovered, that negotiation is the art of constructing new meanings by which individuals can regulate their relations with each other. (p. 149)

Based upon the evidence of my experiences, this does not appear to be happening with the current system. One of my past-times is to find signs in culture and ask what they mean. If education prepared people to be lifelong learners, to revel in complexity, would celebrity biographies, diet books, and money-making formulae regularly top the charts? This is not a slap at those genres; the word “regularly” is pivotal, denoting the endless march of those books directly to the top of the bestseller lists when so many other books - - arguably better, though I won’t argue that here -- languish on shelves, to be quickly remaindered. Would the mega-hits at cineplex theaters always be heavy on explosions and thin on plot and character? Again, no aspersion is here cast on good popcorn fun (though we should remember that even popcorn movies can have a brain and a heart), the operative word is “always.” These observations occur at the gross level of best-seller lists and movie box-office numbers, any weight they have as evidence comes from their weekly, monthly, yearly accumulation. The pattern revealed does not suggest the presence of a golden mean, no balanced diet of cultural sugars and proteins on the national plate. The signs are there to be read: in a review of children’s books, Susie Wildes (1999) attributes the flood of “books that rely on gimmicks, celebrity authors, and movie tie-ins, rather than satisfying stories and illustrations” to a marketing fiat that “finds it easier to push junk books because the public understands them. Like toothpaste, they vary only slightly in flavor, packaging, and additives” (p. 5G). This is nothing more than anecdotal evidence, remember, but what if it contains some truth? It should infuriate us that sales forces should count on our lack of discrimination in these matters, and be

correct to do so. Does this sound like a public that has been educated to be critical thinkers?

Before discussing theories of learning and their possible implementation in a curriculum, here is my philosophy of education. Knowledge should be desirable for no other reason than it is exciting; this way, the usual incentives of grades, jobs, and money do not constrain the path of learning. What I believe is that knowledge gained in this spirit is true, understood rather than memorized for the purpose of passing a test, and that people who learn this way will be well suited for most any job, particularly those that involve ambiguity and indefinite boundaries, categories that describe most jobs in the Information Age if the business press is any barometer. If not, if I am wrong and the natural unfolding of a child's interest in the world is useless in the job market, then perhaps we should examine both that market and the society that created it to see where they are defective.

Good questions to begin with are, How do people -- children and adults -- learn? How do we know truth? Allusions have been made to a belief that I will take as axiomatic: the nonexistence of what Bruner (1986) calls an aboriginal reality "against which one can compare a possible world in order to establish some form of correspondence between it and the real world" (p. 46). This insistence on teaching students that there exists a "correct" version of the world is I think a cause of the death of curiosity in adolescents. A fully determined world where everything is a closed issue is hardly a provocative one for children, who may be excused if they ask themselves, at least on an unconscious level, "What is the point of exploring, then, if all of these matters have been wrapped up in tidy packages that I must memorize?" How much better for

students if they have a part in world-making, a situation perfectly captured by Smith (1990, p. 47): “We learn the worlds we create. The brain is constantly generating possibilities of realities that may or may not exist objectively, and our experience of these realities constitutes our life and our identity.” If I am a teacher, and my choices are to decant my allegedly correct view of the Renaissance to students and have two of thirty pay attention, or to negotiate with them a version for each -- keeping an eye out for egregious errors, and then for the purpose of discussing in what ways the suspect version is inadequate rather than a stern admonition of “That’s wrong, try again!” -- where twenty-six of the thirty are involved because they feel the Renaissance is still alive, “in play” as it were, I think I should choose the latter, though it meant giving up a measure of control over the material. People learn by watching, questioning, and doing, by feeling that their questions matter, that discovery is possible and that the world is open to interpretation. When there is respect for inquiry, people learn, and learn best when the process is playful, experimental, and social. The classroom is no place for intellectual tyranny.

K-12: What We Bring To School

And how do children arrive at the classroom for the first time? In what developmental state? Piaget’s four stages inform contemporary thought: sensorimotor, pre-operational, concrete operational, and formal operational. Each represents a stage of cognitive development and is named for the mode that dominates sense-making during that span. Thus, until the age of two, a child explores the world through the five senses and movement, whereupon a breakthrough occurs and from the age of two until seven the

child uses symbolic functions -- language, number, et cetera -- with varying degrees of success (Wenar, 1990, p. 25). Important to this model, and catastrophic for schooling, is the insistence that each stage utterly supplants the one before it in “a reorganization of knowledge ... so profound that the child does not even have access to his earlier forms of understanding” (Gardner, 1991, p. 26). This is the point with which Gardner disagrees with Piaget; he contends that the intuitive understanding a child forms of the world, including a host of misconceptions, persist throughout the school years, and that “once the youth has left a scholastic setting, these earlier views of the world may well emerge (or reemerge) in full-blown form” (p. 29). Educators, by not confronting these earliest, and quite powerful, worldviews, make possible a scenario where even straight A students possess only the most tenuous grasp of the material, and where end-of-grade exams constitute a nudge and wink to the student: we know you don’t really understand this stuff, but all we ask is a little regurgitation and we can all feel good about ourselves.

The work done by Gardner and his colleagues illustrates a model that captures much of the idiosyncratic complexity of child learners, complexity that allows for -- demands, really -- flexible responses on the part of educators. I will rely on their work to help me sketch an image of the child as she enters school. To begin, Gardner borrows from the developmental psychologist Katherine Nelson a concept called script knowledge, defined as “the identification and ordering of those features that are reliably associated with a recurrent event” (p. 67). This knowledge functions as a touchstone for new events as well as a mnemonic, and an enterprising teacher who is mindful of a script similar to the subject matter at hand can use said script as a Trojan Horse of sorts: couched in a known formula, the child will accept, even enjoy, the new material.

Ignorance of these powerful scripts is dangerous, for “they can often cause students (as well as nonstudents) to misperceive events or to misremember them. That is, one may revert to features of the generic script rather than faithfully preserving its variations, elaborations, or deviations” (p. 67). Here is a case where interpretation of the world can go wrong, because, rather than truly doing the work of interpretation, the child is banging a square peg into a round hole; the previously mentioned example of the Renaissance teacher on the watch for egregious versions is here germane.

“Pretend play” is that quality whereby children move beyond representation to meta-representation: the ability to pretend that, in Gardner’s (1991) example, a banana is a telephone, to be aware of the pretense, of the fact that others can likewise pretend, and that the pretense can be appreciated by others (p.70). The birth of the imagination. From pretend play will come art, and theories of the world. Teachers need to know what they are up against here, too. Official theories learned in school, whether of painting or physics or biology, which mesh smoothly with the child’s intuitive theories, will be understood, but those that clash will cause confusion and at best will be memorized until the ordeal of school is over (p. 71). Again, knowledge of how children parse the world is invaluable.

Before continuing the sketch, some terms. Gardner is best known for his theory of multiple intelligences. In addition to the pair that are most frequently and directly addressed by current educational practice -- linguistic and logico-mathematical -- he postulates the existence of spatial, musical, kinesthetic, interpersonal, and intrapersonal intelligence. The validity of this theory, the possibility of a physical correspondence in the structure of the brain or a mental correspondence in the working of the mind, is not

my concern here. For now, it is enough that the model of intelligence has increased in complexity by a factor of seven over the previous model. Someday in the future, neurophysicists may look on this theory and marvel at its feeble grasp of such a labyrinthine organ as the brain. Well and good. That is how I feel with regard to the older paradigm of an IQ that definitively measured -- so it was alleged for many years and continues to hold sway in many school systems -- the intelligence of all people and all ages. Seven intelligences is much more inclusive, and better fits an era of diversity and multiculturalism than does a standard that penalizes those not fluent with written language or numbers.

Each of these intelligences has its own stream of development, the progress of which, unlike in the Piagetian conception, is not related to that of the others. These streams are structural, a quality that in language is called syntactic (p. 58); Gardner (1991) contends that each intelligence has an analogue of syntax, such as tonality in music or layout in three-dimensional art, and that these syntaxes may be genetically constrained (p. 74). The constraint that springs immediately to mind concerns dimensionality in art: human beings live primarily in two-dimensions, can perceive three, but four is impossible to grasp. When we try, we fall back to our three-dimensional model as the closest approximation, failing then by definition to generalize a scene into a fourth dimension. Trying to imagine a tesseract becomes an exercise in cerebral tail-chasing. Understanding such constraints within each stream can give a student profound appreciation for the achievements of Picasso, Magritte, Einstein and others, artists and scientists, who tackled exactly this task -- envisioning a new dimension -- in their work.

Concurrent with the domain-specific streams of development are four waves of symbolization; these are analogues of semantics in language and, while tending to arise within a single symbol system, customarily spill into other systems (p. 74). Semantics, according to Gardner, is that relationship which exists between the symbol and the referent, between, for example, the word and what it refers to (p.57). Mutual exclusivity is the salient aspect of semantics (though currently under challenge, it remains untapped), the impossibility of an object having two names at the same level of specificity. To use Gardner's example (p. 62) a chair can belong to the greater category of furniture and it can have synonyms, but people will not accept another word in place of chair -- bottomstop, perhaps, or, further afield, plangangle -- such a word would be regarded as nonsense. It is easy to see how pretend play and, at a more sophisticated level, metaphor, are concerned with unhorsing referents from symbols, whimsically switching meanings and creating new ones for everyday objects. It's not just fooling around. One of the great epiphanies gained from the research for this essay has been the respect that scholarly attention and language have conferred on make-believe and daydreaming, and I say that it is about time. Education has ignored the potential of these qualities and written them off as childish things to be put away when it came time for the serious drudgework of school.

Between eighteen months and two years a child experiences the first wave of symbolization, that of role-structuring. This wave arises in language, and entails the child's ability to capture "in symbols his knowledge that there are events, that these events involve agents, actions, and objects, and that these events have consequences" (p. 74). Topological mapping, the second wave, occurs at age three. It is spatially-oriented

and is characterized by the use of symbols to capture size and shape relationships that can be seen (p. 75). One year later, at four years of age, the child begins to grasp numerical quantities and relations in the digital mapping wave of development, and then, as early as five or as late as seven -- and Gardner points out that it is no surprise that this coincides with the onset of formal schooling virtually everywhere -- the final wave, that of notational symbolization, rolls in (p. 76). Here children begin to use systems or schemes that allow information to be codified; these are aids to memory, mental prostheses that allow great portions of the world to be reduced and managed in the mind. Gardner's example of how notational systems can be embedded one in the next to extraordinary effect is that of mathematics, "when multiplication presumes addition or when algebra presumes arithmetic" (p. 77). By the time she begins school, the student has access to all four symbol systems. Sometimes the overlap of one system into another domain will result in a creative, fresh approach to a problem, other times it will be counterproductive. Gardner's cautionary note offers a way to evaluate curriculum materials for efficacy; he warns that everyone connected with education should be aware of these symbol systems "lest they invoke them inadvertently in inappropriate ways -- for example, confusing a concept that functions in quantitative manner (like density) with one that exhibits narrative properties (like the life cycle)" (p. 78). With this in mind, teachers can evaluate learning materials, whether worksheets or CD-ROMs, for a disconnect between symbolization and concept: tools festooned with cute characters that "guide" children through a story-lesson that concerns, say, physical science, may not be worth the money invested, however much fun they are to play. The resultant learning may be of the shallow sort. This is not to say that such approaches cannot work, only that care must be

taken during the design process. Designers of creative materials must look for avenues by which to engage those children whose strengths do not map to the intelligence usually associated with the subject at hand -- for example, a math exercise designed with the kinesthetic-interpersonal child in mind. Rich curriculum materials will include avenues for as many intelligences as possible. Gardner (1991, p. 245) believes any topic can be accessed five different ways: narrational, foundational, logical-quantitative, experiential, and by means of the aesthetic. Curriculum builders might do worse than to stipulate that all five access points be represented in every tool and exercise.

As the child enters school at age six, she already has an awareness of different genres within each symbolic system, what Gardner (1991) calls “channels” (p. 78). There is another opportunity here for the curriculum designer and the teacher. Lessons that explore various genres would take advantage of this awareness; for example, students might approach a topic -- a birthday party -- from multiple genres: comedy, tragedy, satire, farce. Meeting this awareness face-on and integrating it within the curriculum means that the student is less likely to have a limited repertoire in later years, less likely also to choose the wrong genre for an assignment and to make a genre do something it was never meant to do.

Children also bring certain constraints of perspective to school which need to be understood. These worldviews concern ontology, number, mechanics, life, and mind. Some of these are correct and some are serviceable but perhaps not quite accurate, and it is the latter that school, as presently constituted, fails to address at a level of depth sufficient to persuade the child that, for instance, a whale actually is a mammal (Gardner, 1991, p. 87). In a child’s ontological perspective, objects are classed according to criteria

such as living and not-living, tangible and immaterial, and in the recognition of difference is found another source of metaphor-making if only it is acknowledged by educators (p. 87). An intuitive “theory” of life might grant life only to entities that move, excluding plants while including clouds, resulting in what Piaget called the animism of childhood (p. 91). This worldview can be corrosive, if unchecked, to a true understanding of disciplines such as physics and biology.

On the other hand, direct address of such animism in an educational setting can, while helping the student understand science, enrich education in the arts; I see immediate application in the skillful use of imagery, symbolism, objective correlative, and pathetic fallacy, among others. And as for the conception of mind that is brought to school by the child: he is capable of first- and perhaps even second-order belief (p. 93). First-order belief amounts to placing oneself in another’s point of view -- what does so-and-so think of this painting? -- while second-order carries this recursion one step further -- what does so-and-so think that I think of this painting? It is now possible for the child to grasp sarcasm and irony, to be empathetic, to not assume that others hold the same beliefs as does she -- possible, but difficult, because even adults struggle with these, the last two most of all. The problem is that none of this is addressed in school, but rather taken for granted. Therefore, these earliest patterns of thought -- specifically, the not-quite-accurate and the just-plain-wrong -- are allowed to persist into adulthood. Entirely too little is made of the brain and the mind, of the fact that one person can think herself into the mind, the viewpoint, of another person. This is where the child needs to maintain a sense of wonder about both herself and the world, and it is this sense of wonder that school annihilates by treating the astonishment of “mental projection” as a ho-hum affair.

Another set of constraints comprises stereotypes, performances, aesthetics, and personality. The first involves script knowledge and canonical events; there is an expectation that narratives of both fiction and life will play out according to these events. The result can be that complex storylines, in a novel or in history, are reduced to simplistic dualities and that people are stereotyped according to gender, race, occupation, or the demands of a role (p. 99). More teleology: I find evidence that school fails to counteract these tendencies in the number of adults I know and have met, college graduates and all, who fall prey to these easy solutions, as if our school system were producing a host of modern Manichaeans. If “purpose shapes process,” (Perkins, 1981, p. 101) then graduates who reduce even the most complex political or fictional situation to an easily-digestible polarity illuminate a school career where such was either allowed or encouraged. The aesthetic sense developed by children governs what they will consider successful in any creative endeavor, and while some may have a sophisticated sense due to their home environment, many will rely on a rudimentary schema (p. 101). The failure to address this elementary aesthetic enables it to persist into adulthood, where it may be manifesting itself in the form of an exaggerated appreciation of Adam Sandler films as well as the lack of balance in reading habits mentioned earlier in the essay.

K-12: What We Find At School And What We Might Find

This completes the sketch of a child learner as he enters school. This potent cocktail of enthusiasm and potential arrives at school and -- what? What happens? The young learner encounters lines for lunch and recess, and bells that signal feeding times and playtimes, and authority figures with whose declarations and decrees there is no

quibbling, and rote exercises the ultimate purpose of which is “Because you’ll need to know this”, and an existential class experience of being one among many, a small, former demiurge who must sink or swim alone in a class of thirty. And in case I have not been clear, some words from Tracy Kidder (1989):

The problem is fundamental. Put twenty or more children of roughly the same age in a little room, confine them to desks, make them wait in lines, make them behave. It is as if a secret committee ... had made a study of children and, having figured out what the greatest number were least disposed to do, declared that all of them should do it. (p. 115)

That was written in 1989, but little has changed. It is almost as if our society has a hidden agenda for school. We say we want well-educated, vibrant thinkers to emerge, but we then set children a course that insures few of them will be made in that image. School seems most to resemble a boot camp for the (usually) grim reality of a nine-to-five existence.

A viable curriculum rationale will contain some goals and some values that overspread them. I find the following to be values worth staking an education system on: sense of wonder and curiosity. Goals that might provide a connection to those values are lifelong learning and critical thinking. Axioms that undergird these lofty sentiments include the equality of and interaction between art and science (Goodman, 1984, p. 192), the idea that emotions provide knowledge (Perkins, 1981, p. 121; Goodman, 1984, p. 147), that anyone can create and can demonstrate imagination (Perkins, 1981, p. 246; Smith, 1990, p. 53), that teaching does not occupy a privileged position with regard to learning (Lave & Wenger, 1991, p. 40; Goodman, 1984, p. 156), that thinking requires experience rather than practice (Smith, 1990, p. 136), and that thought creates realities (Smith, 1990, p. 109).

The broadest patterns here concern generalist and specialist education. Following Gardner (1989), a pendular rhythm feels best, one that commences with the general in grade one and continues through the next year, then a shift to the specialized for grades three through nine, and last, a return to the general and holistic for tenth, eleventh, and twelfth grades (p. 154). Within each grade, however, smaller back-and-forth patterns are embedded, so that the students feel comfortable with the idea that the two approaches offer unique ways of knowing.

The early years are laissez-faire years. Smith's (1990) characteristically acerbic thrust, "The conclusion that many experimental psychologists have ignored and that many educators have found difficult to tolerate is that learning is easiest when external control is relaxed" (p. 42), is never more applicable than during this time. During this time, school should be indistinguishable from play. In Western society, play has an undeservedly bad reputation. The result of this is a terrible conflation of high seriousness and tedium with "meaningful work," and the result of that is a modern work world that resembles a poisonous mix of hospital I.C.U., battlefield, and race track, spawning heart attacks, ulcers, hypertension, layoffs, bad marriages, broken homes, and a sour educational philosophy perfect for continuing the original conflation. It is probably too late for most of us over the age of fifteen, but we can at the least show youngsters that it does not have to be so. This is another reason why I think the much-touted "business model" for schools is a bad idea.

Play, particularly that of children, packs as much learning into a minute as most adults manage in a week. A startling idea here from Lev Vygotsky (1978): "A child's greatest self-control occurs in play" (p. 99). This sounds counter-intuitive, but think of

game rules; every game, even the most fantastic and made-up, employs a set of rules (though possibly invisible to adult eyes) which must be obeyed, else there must be passionate, perhaps even logical, explanation for the breach or the proposed alteration. Banning play from school -- the only exception kickball at recess -- was ill-advised, for teachers lost access to a great reservoir of discipline on the part of the children themselves. Bringing play back into the fold, integrating it with the lesson plans, should increase the amount of true learning that occurs while decreasing the discipline problems. How does it help learning? Again, I think Vygotsky has the right of it; he postulates that play creates a zone of proximal development: "In play a child always behaves beyond his average age, above his daily behavior....As in the focus of a magnifying glass, play contains all developmental tendencies in a condensed form and is itself a major source of development" (p. 102). The zone of proximal development, simplified, is what happens when one person tutors another; specifically, when a teacher models a process or solution for a child, generally, as in Bruner's memorable description of his elementary school teacher, Miss Orcutt: "She was inviting me to extend my world of wonder to encompass hers. She was not just informing me. She was, rather, negotiating the world of wonder and possibility" (p. 126), or as in play, an auto-tutorial process. It's been right there in front of us all the time, but we dismissed it because it was only "cute" kid stuff. Vygotsky, however, unearthed its potency: children dress up and play school, doctor, have tea, enact pageants, and generally launch a Protean assault on the mores and codes of the adult world.

Gardner (1989) recommends the grade three shift to a domain specialization approach because children around age eight interact with the world in a way entirely different from younger children:

They want to master the rules of their cultures and of its specific vocations and avocations. They want to use language precisely, not allusively; they want to draw pictures that are photographically realistic, not fanciful or abstract....[Now] it is important to master the notational systems of the culture....[Notational systems] must build upon and relate to the “common-sensical” understanding of domains that has been achieved in the preschool years....Otherwise, the child may be burdened with two disembodied systems of knowledge, neither adequate on its own, rather than one integrated understanding. (p. 158)

This is the time to confront the misconceptions about the world, discussed earlier, that arise during the first six or seven years of life, the same ones that currently go unaddressed and are responsible for honor-level physics students who nonetheless display a medieval understanding of the laws of motion (Gardner, 1991, p. 3).

Gardner (1989) advises a shift back to a general approach at age fourteen, because at this time the student’s world has become wider, higher, and deeper: she has access to a greater swath of society, is able to engage in ever more sophisticated reasoning, and is capable of sustained introspection (p. 160). Excessive vocational training and tracking no longer seem like such good ideas; each prematurely closes off options along with vast portions of the world, leaving the student with an arid conception of knowledge structures.

Even at the level of high school, some of the earlier laissez-faire persists. This is due to a difference between the quality of private thought and that of social thought (Smith, 1990). The mental gears tend to stick and grind when we must think at someone else’s bidding, a feeling everyone has had: in the spotlight, the words needed to express ourselves refuse to come, whereas alone, we fashion the most elegant arguments. This is

because in private, “We usually know where we are coming from and where we want to get to, and our thoughts can range without the inhibition of other people’s reactions” (Smith, 1990, p. 28). It is those reactions, however, those expectations on the part of peers and, especially, teachers, that foul us up. This is why variation of performance and demonstration is in order; a blend of small groups, whole class, teacher-student mini-meetings, field trips, and so forth, will insure that each day does not loom, especially for those weak in interpersonal skills, as yet another grim edition of grade school golgotha.

Another dictum governing education at this, my imaginary school, is provided by Bruner (1986):

That the medium of exchange in which education is conducted -- language -- can never be neutral, that is imposes a point of view not only about the world to which it refers but toward the use of mind in respect of this world. (p. 121)

This guideline fits well with a constructivist orientation toward learning; as there is no purely objective world for us to discover, so there is no objective language with which to describe it. Teachers need to engage in a dialogue with themselves, analyze the language used, question any assumptions made: relieved of the pressure to be an all-knowing oracle for students -- Perkins’ (1986) “teacher as a model of ignorance” (p. 318) -- they may feel free to play Devil’s advocate with themselves while in class, offering a paragon for the children. Of course, this questioning must be practiced on the students, too, until everyone leaps into the act, and the notion that anyone is a repository of “right thinking” is destroyed. Not that some experts don’t have answers, just that the assumption won’t be automatically made, and certainly not about one’s own opinion, an assumption of omniscience that is an epidemic in this country – read any op-ed section of any

newspaper -- and arguably one of the most irritating qualities about the national discourse.

This caution with language is crucial for any who wish to make use of the zone of proximal development as an educational tool; as Bruner (1986, p. 148) warns, such tutoring, reliant as it is on unequal balances of power, age, and knowledge, is ripe for abuse. An entire class might therefore be constructed to examine language, how it begins in the world, how it changes, and how it shapes society. A fitting epigraph for such a course might read like so: “Are those sociohistorical forces that shape the language that then shapes the minds of those who use it, are those forces always benign?” (Bruner, 1986, p. 148). A survey of the effect corporations have on the language could take years by itself.

I believe this sort of dynamic reflection is a fruitful area for curriculum design, and would like to provide another example, something I call meta-schooling. Originally, I thought to make a rule: no textbooks. My K-12 experience, one that I trust others shared, was of an endless parade of dry textbooks, each shorn of anything that might be of interest to a student. I still think that textbooks do great harm by encouraging the belief that “here” is codified the correct version of whatever -- history, literature, even science. The impression given is that the “facts” contained within the textbook represent finality, that these are all closed issues, that “No, you may not read the American Revolution from the Iroquoian point of view,” or “Don’t even think about comparing Goethe’s treatise on optics with Newton’s -- we declare Newton the winner, and that should satisfy you.” This is why students find history dull, among other subjects that might also be mentioned.

However, I don't want to be inflexible. I think textbooks make excellent study material -- not for what they refer to, but in and of themselves. Gather textbooks from several disciplines, from several eras -- history books from 1905, 1920, 1930, 1945, 1962, and 1995, for example -- and spend a semester deconstructing them. Out of what historical context were they born (note how this is a surreptitious way to also, almost by accident, study history)? What agenda is espoused? How easy or difficult is this agenda to detect? What is the purpose of said agenda? What effect may such textbooks have had on the students and the society? In today's world, where do we see the fallout of these effects? How sure are we that we have read the text correctly and are not merely superimposing our own agendas, opinions, and the agendas and opinions of our own schooling and society, onto these older versions of history?

This is almost too easy. Rather than a laundry list of names and dates and battle sites, the stunning notion that history has a context. Mirabile dictu! Since history has offered itself as an example, some thoughts: we teach history out of fear. That fear is of failure, and is completely self-fulfilling. The omnipresent survey course -- all of American history (after a nod and a dash past that boring pre-Columbian era) or all of European history or (favorite of favorites) all of World History -- in a single semester should be familiar to everyone. College is guilty of this as well, but that institution is beyond the purview of this essay. Think of it. Sheer, unadulterated hubris, this idea that all of that living and dying, all those ideas and inventions and songs, can be squeezed, into such a tiny ball of time ... and still hold the interest of any but the most dedicated. As the teacher speeds past political movements, schools of poetry, meetings of Congress, breaking the sound barrier as she presses to cover it all, students fall off and away.

Dizzied and stunned by the blur of people and places. What is this? Who thinks this is the way to get students involved in learning? Now, the fear -- we demand that students swallow such vast chunks of raw time ostensibly because “they need to know this,” but actually because we fear that if they aren’t exposed to this stuff now, while we’ve got them as a captive audience, they’ll never be so exposed. And we’re right. They never will, but that is because we made such a hash of teaching it that “school” functions as aversion therapy, setting up the life-time equation “history = painful boredom.” In my school, we would do it differently.

First, history and time are not equivalent. The grave mistake is that school confuses the vehicle of history, which is time, with history itself. History is that which precipitates through time as incident and action. History is the price of eggs and the fight card at the armory on such-and-such a night, not just the ponderous motion of armies. With this in mind, we can relinquish the need to show students a fleeting glimpse of everything. Instead of a Grand Tour of European History -- accompanied by the snores of sleeping students -- we trust our teachers to work up rich courses around some theme or period. This semester, the Renaissance, next, Culture at the Native/Settler Boundary. What did they eat? What music was popular? What was the price of eggs? How did they honor their dead? Why did they fight? How did they make peace? As I said, it’s almost too easy. A mix of lecture, discussion, hands on activity (let’s cook Kinaalda Cake!), guest speakers, field trips, projects, pageants, insures that the children know the period or theme. Know it as an era that was alive and is yet still living, recognize the similarities between them, then, and us, now. The shock is palpable when it comes -- this stuff is relevant! Here is the secret: it doesn’t feel like history. It feels like adventure.

The gamble I propose is this: if we make history vivid we don't have to worry that students never memorized the presidents or were "exposed" to the great thinkers of Europe, and we don't have to worry because they actually like to learn and they understand that history is more than boring dead people and outmoded ideas. As they continue to learn, they'll discover the rest of history on their own. We send children on into the world, certain that we have ignited their learning rather than doused their curiosity. This stance takes courage, but can hardly achieve less than the present system.

I find further justification for this meta-approach in the "situated learning" viewpoint of Lave and Wenger (1991), who expose one of the key fallacies of current school practice, a fallacy that I find disingenuous as well: "The organization of schooling is predicated on claims that knowledge can be decontextualized, and yet schools themselves are social institutions and as places of learning constitute very specific contexts" (p. 40). Gardner (1993, p. 122) and his colleagues at Harvard's Project Zero addressed this issue with an infusion curriculum known as PIFS (Practical Intelligences for School), but the subject is fascinating, so I will add some comments.

At every possible moment, K-12, education should be transparent to the students, they should see the machinery at work. This may take the form of a class that examines the school system -- how it's funded, what powers are granted the school, board, and yes, the methods by which curricula are built. Perhaps another class might construct the class as it goes -- a bold experiment in negotiated learning -- alternating a week of resource selection and discussion followed by a week of work with the selected resources. Here the teacher can focus questions on the purposes served by educational materials, what makes some better than others, and how best to present those resources to the students.

Teacher and students learn something of the other's role, which can only lead to greater appreciation for the work performed on both sides. A variant of this module might be to have the class design coursework for younger students, the final product to be implemented the next school session. To fully grasp the complexity of this task, members of the designing class might then interview the younger students to see what they liked and disliked about the course. Ideas such as these may help students comprehend school better; part of their disenchantment may stem from the feeling that they are lab rats acted upon by powerful, mysterious, and ultimately unknowable beings.

Opening another front, any curriculum must adopt some stance toward the relationship between science and art. The popular notion, fueled by the kind of simplistic mass media attitude encoded in a headline such as "Are Predictions Just Fiction?" (O'Neill, 1999), is that the twain never meet, that they are as oil and water, objective and subjective, left brain and right -- again, the reliance on easy dichotomous thinking -- and are in general sworn enemies. And what is the status of art in this society? We complain that children read too few books and watch too much TV, that the quality of the national discourse is low, that too few people read "good" books, however those are defined, that fewer still use libraries and museums and art galleries and yet, given the priorities of our education system, should we be surprised? All of the above to some degree involve the arts, but the message we receive during our school years, especially during middle and high school, is that the arts are second-rate and of little value compared with science. Whether we process this message consciously or not, we all get the picture when some manner of science and math is required from sixth grade through twelfth while art and music are relegated to the status of an elective, educational argot for "trivial."

The offending headline mentioned above represents decades of subtle anti-art -- shall I say it? -- propaganda. The word “just” is the telling stroke. “Just” fiction puts fiction in its place, makes it the opposite of truth -- another dichotomy. Fiction is made a synonym for “inaccurate” and always, always, reduced to “mere entertainment.” “Mere” because while entertainment does not of necessity indicate an absence of intelligence, the search for polarity usually insists on just such an indication. There is Art, which is gloomy, difficult, forbidding, and cranky, and then there is Entertainment, carefree, happy, light, and easy. So who wants to be an Artist? And, more to the point, who wants to spend more than half a second in the presence of Art? Contrast this dismissal of fiction with Smith’s (1990) affirmation:

Novelists can disclose as much about the nature of people as psychologists and sociologists, not because writers occasionally behave “scientifically” or “systematically,” but because psychologists and sociologists can only see the world in the same fundamental terms as novelists, no matter how much they envelope their research in esoteric techniques and abstruse jargon. (p. 147)

Before we can dream of a population that uses art for both entertainment and the generation of other worlds where possibilities and alternatives abound (Smith, 1990, p. 47), there must be a great change in the attitudes toward art modeled for children in school. Much depends on how people decide to frame a concept; right now, society has built a glass ceiling for art, so that art must either be light and therefore popular but forfeit any claim to importance, or, in a gamble for importance, remain unpopular and ripe for lampooning as “uppity,” with uppity here translated as, “What do you think you are, science?” The Catch-22 for art is that society only grants transformative power to science; art is what we beguile a hot summer afternoon with in a cool theater or on the beach. Smith shows us that it is possible to reframe the dialogue between science and art;

after all, if each of us constructs reality, then the art/science split isn't a "real" artefact of the world, but rather a product of our collective mind. The way to change is to teach children that art and science provide different ways of knowing, each valid and each connected to the other in surprising ways.

Goodman and Bruner offer catalyzing agents with which to begin building the literature and writing portions of a curriculum. Goodman's (1984) five theses for fiction -- that all fiction is literal, literary falsehood, that some fiction is true, that the truth of fiction has nothing to do with realism, that there are no fictive worlds, and that not all literal, literary falsehood is fiction (p. 123) -- offer great complexity for both teacher and student. A seminar concerned with deep understanding of all five theses, along with a concurrent application of same to a group of novels, would represent progress. Such a seminar would also be interdisciplinary, since Goodman's theses cannot be grasped without recourse to philosophy.

If Goodman's theses operate at the stratum of voice and style, then Bruner (1986, p. 25), drawing from the thought of Wolfgang Iser, helps us work at the interstice of style and craft by means of three concepts: presupposition, subjectification, and multiple perspective. Students learn how these ideas enable a writer, in tandem with a wise reader, to subjunctivize reality, described by Bruner as that modality in which the reader is "trafficking in human possibilities rather than in settled certainties" (p. 26), an aim that should be quite familiar now as part of my agenda for wonder. And "wise" modifies "reader" because that is a goal of the course, the creation of wise readers.

Making The Sense Of Wonder Operational At Ground Zero: The Classroom

So far my examples work at the semester level or smaller, preserving the traditional boundary of grade. In keeping with my belief that anything is a candidate for change, my final concoction presumes to overrun those boundaries, those of the high school years, specifically. It begins with a map.

The mission for these ninth graders is to build a world by the time they graduate. In middle school they learned specific things about the disciplines that will be called upon now. Right away, the geometry and trigonometry of seventh and eighth grade see action, not only in class, but out in the field, too, as clumps of fourteen and fifteen year olds spend time with surveyors. At the end of this time, they employ map-making skills by charting several portions of the city or county, which charts the surveyors critique. Geology and geography, perhaps some meteorology and study of climates, follow, and during this time the bare specifics of their world are revealed: tilt of planetary axis, periods of revolution and rotation, number of moons, sun type, world diameter, mix of elements in both atmosphere and crust, and ratio of land to water. The students employ their new knowledge and fashion a map that shows distribution of continents, mountain ranges, rivers, and so on. Using Earth for comparison, how does climate and terrain reveal itself through, and influence, culture?

At this point, the study of cosmology and cosmogony is appropriate. Who are the people of this world? How have they adapted to the climate? What do they believe in? When they look at the night sky, what do they think? Students and teachers together will gradually decide what level of technology has been reached, again with reference to the history of Earth as a touchstone.

As the broad questions are answered, a process that might consume the first year, the project moves to finer levels of granularity. What instruments have evolved, and how is music from the various cultures constructed? At this point, one option would be to place groups of students in charge of different continents and build in mechanisms for frequent communication between groups – few cultures exist in total isolation, though it is possible. Interludes of recursion should be built in, days when everyone loops back to previous lessons, particularly when natural affinities arise. For example, revisiting mathematics when students begin to imagine the music of this other world. In this way, students are able to apply various lenses to the project, rather than slogging through a strictly sequential process. Dances are created, art conjured, means of transportation and communication explored, literature written, all with an eye toward the world that shaped them. There is a constant examination of Earth as a version that works, a plundering of history and ideas that can be reworked for the new world or used as platforms from which new concepts are launched. By the end of twelfth grade they have a world project that can be presented to the community on a number of levels: art shows, concerts, demonstrations of science and engineering, poetry readings, plays, publication of short stories or tales.

The preceding was a sketch only, but its value is that it challenges every manner of intelligence, is amenable to different learning styles, and grants all concerned the latitude to negotiate the course of learning. Evaluation can be built into the day by day activities rather than levied on the students at intervals almost as a punishment. I would rather have students at home thinking about how to adapt the Norse saga to the people of

their continent, and doing independent research, instead of memorizing dusty information for a midterm exam.

A curriculum rationale is by nature a justification: of values, of goals, and of means. What I found useful in the pursuit of this rationale – theories of development, intelligence, and learning patterns – I included as a kind of road map to my travels in the literature. Much was left out of this account. I found the ideas so stimulating that a few went a long way. Where my comfort level was sufficiently high, I ventured to sketch examples that embodied some of those ideas. In so doing, I found it helpful to imagine myself a young learner again – what would spark my interest? What approach would catch me off-balance, so to speak, and make me take notice? None of these fantasies involved the transmission model of learning, no teachers dispensed knowledge from the front of the class to a group of ambulatory receptacles. The school-museum fusion and the use of apprenticeships, the notion of a school integrated with its community by means of field trips and off-site learning centers, and a pool of experts, be they welders or dancers, willing to serve as guest teachers or to host small groups of students in workshop or studio, all ideas championed by my sources, these are concepts with promise. By such means, we might realize Smith's (1990) utopia:

Educational institutions...should be places where relevant and worthwhile thinking is embedded in every activity of the day, not as an exercise or subject matter, but as the way things are done. Teachers should demonstrate the power and possibilities of thought in everything they do, and by never engaging their students in meaningless, thoughtless activity. (p. 125)

Right now we are far from that. In part, this is because of how society treats teachers. The list is too well known to merit a reprise here, but one thing bears mentioning, another point made by Smith (1990) – students will never grow to become

independent thinkers when they are told “what they should learn, and what they should think about it” nor when their immediate adult model of inquiry, the teacher, is told what he will teach and how it should be taught (p. 128). This rings true, and end-of-grade exams seem an excellent path if what we want is the opposite of independent thinkers.

The privatized model urged by business is no good. For one, education is not a business, however much CEOs salivate at the thought of a national system churning out battle-ready junior executives and line workers. For two, this model is barren, incapable of producing rounded individuals. Gardner’s (1982) insight that children must have many experiences and the opportunity to reflect on them is worth quoting: “Possibly the most profound achievements involve the whole person, an individual who has sought to come to grips with himself: only through unsparing self-examination is such deepening likely to occur” (p. 199). My only change would be removal of the qualifier “possibly.”

Back to basics, the other popular rallying cry, has earlier been dispensed with. I would like to say the time has come to move beyond basic goals and simplistic assessments and show children, by means of an educational overhaul, that it is possible to engage with complexity. The authors here referenced show us how to meet children on terms set by children rather than the arid and depressing rules of behaviorism. It will demand money and understanding of the public, power-sharing of the educational bureaucracy, profit-sacrificing of textbook publishers, and creativity of teachers, but the prospect of children learning is one of the most compelling reasons I know.

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